as possible to minimize any gap between the top surface of the tile **100** and the back surface of the integrating structure **1220**. Alternatively, the mullions **1310** may be assembled onto the integrating structure **1220** with the black matrix lines. In this configuration, the mullions form pockets into which tiles **120** are inserted to form the composite display. This structure may be formed by attaching the mullions directly to the integrating structure **1220** using an adhesive and then applying an adhesive to the undersides **1414** of the crossbars **1410** and to the sides **1412** of the stems before inserting a tile into the display.

[0084] The black lines on the optical integrating structure **1220** that form the mullions which are used to cover the inter-tile gap tend to be wider than the typical black matrix line and may block some or all of the light emitted from the pixels near the edge of the tile. To allow the maximum amount of light to pass and yet avoid any artifact distortion in the assembled display device, the display tiles and the black stripes on the integrating structure **1220** are desirably specifically designed to have particular relationships.

[0085] **FIG. 17** shows a cross section of a pixel which includes two pixel regions. The emissive regions **1710** at the bottom of the glass substrate **120** have a width d_p. The light rays that can exit the glass section and are useful for viewing, exit the top of the glass **120** in an area having a width $w=2\ d_c+d_p$. A display device has an array of pixels equally spaced a distance known as P, the pixel pitch. Therefore, to not block any viewable light, it is desirable for the black matrix to have a width, $W_m \leqq P-d_p-2\ d_c$. The dimensions illustrated in **FIG. 17** depict the case where the black matrix stripe blocks no emitted light.

[0086] When the thickness of the glass substrate **120** and the width of the black stripe satisfy the criteria described above, no light that is directed toward a viewer directly in front of the display (e. g. viewing from a normal angle) is blocked, but some light from greater viewing angles may be blocked. Meeting these criteria, however, leads to improved contrast since the fraction of the display occupied by the black matrix is larger. In other words, some blockage of light from wider viewing angles may be considered acceptable as being advantageous for higher contrast at normal viewing angles.

[0087] As described above, in the exemplary embodiment of the invention, the pixels on the exemplary display device have an aperture of approximately 25% in order to allow room within the pixel for a via to make electrical contact with a column electrode. Thus, in the exemplary embodiment of the invention, d_p is approximately P/2. This relatively small aperture also has advantages by making it easier to hide the inter-tile gap and allowing a relatively large stripe size for the black matrix to improve the contrast of the display.

[0088] There are two criteria for the width of the black stripes: $W_m \geqq 2\ d_c$ (needed to hide the gap), and $W_m \leqq P-d_p-2\ d_c$ (needed to avoid blocking light from the pixels). These criteria are plotted for one example (i. e. $P=2\ w_p$) in **FIG. 18**. The design conditions that simultaneously makes the gap invisible and does not block any visible are shown on **FIG. 18** as the desirable region **1810** of choices for the glass thickness and the black stripe width. The most desirable solution is the design point **1812** having the greatest glass thickness, at the top of the acceptable region. At this point, the thickness of the glass is 0.015 P and the width of the black stripe is 0.25 P. Designing the display module and black matrix stripes to meet that condition results in making a large area display by integrating individual modules behind the integrating structure **1220** with the result that the individual modules are not detectable by the gaps between them.

[0089] At the design point **1812**, light is not blocked at any viewing angle. The design condition **1814** in **FIG. 18** is better than design point **1812** because it provides the maximum contrast and maximum thickness glass but with a significant loss in the brightness of the display device for off-axis viewing. In the triangle **1816**, some light is blocked off axis but contrast is improved by reducing ambient reflection.

[0090] It is contemplated that the contrast may be further improved by coating the viewer-side of the integrating structure **1220** with an antireflection coating and/or by adding an ambient light absorber or color filter, such as the filter **121** described above with reference to **FIG. 1**, on that surface or in the bulk of the material (e.g. glass or plastic) from which the optical integrating structure **1220** is constructed.

[0091] It is also contemplated that the integrating structure **1220** may include a diffuser coating on the viewer-side surface. This diffuser enlarges the apparent size of the pixels reducing the visibility of the individual pixels and black matrix structure. Thus, a diffuser may act to reduce the graininess of the displayed image. The diffuser also acts to reduce specular reflections. Accordingly, at viewing angles which include specular reflections, the diffuser enhances image contrast. This may be significant, especially for display devices having relatively large pixels or which have smaller pixels but are designed to be viewed at close proximity to the display device.

[0092] Another method of reducing the visibility of the pixel structure is to employ a quad pixel structure having separated sub-pixels, as described above with reference to **FIG. 8**. This pixel structure provides relatively high levels of brightness even in display technologies which do not have a bright phosphor for one color. The separated sub-pixels of this quad sub-pixel structure also provide good contrast and an apparent increase in spatial resolution.

[0093] The integrating structure **1220** provides a relatively simple yet accurate way to align and mount the individual tiles of a tiled display device. In particular the patterns on the integrating structure **1220** may be accurately aligned with the pixels using, for example moiré patterns, to position a tile and then the tile may be mounted onto the structure **1220** with an optically clear adhesive, for example, a ultra-violet curable epoxy.

[0094] The present invention contemplates other methods than the integrating structure for providing a black matrix on a display device. One method is to form the black matrix from a light-absorbing material on the viewer surface of the glass substrate **120**. Another is to include a light absorbing material close to the plane of the pixel, for example, as the item **121** shown in **FIG. 1**. If an absorbing material is used outside of the active pixel areas of a display device, then is desirable to minimize the size of the emissive area and maximize the area of the absorber while maintaining a